Programme: M. Sc. (Marine Sciences)
Course Code: MSO 363 **Title of the Course: Ocean - Atmosphere Coupling and Climate**
Number of Credits: 04
Effective from AY: June, 2018-19

Prerequisites for the course:	Physical Oceanography and Marine Biology
Objective:	To learn exchange of mass and energy across air-sea interface and its role in global climate.

Content:	Wind generation, forces acting on wind, Geostrophic winds, thermal winds. Wind wave generation, scale of interaction, General character of sea surface as a lower boundary of air flow – Geometry of the sea surface – The wind field in the maritime frictional layer. Drag coefficient. General consideration of air sea interaction – Planetary boundary layer - Laminar boundary layer, surface layer and spiral layer. Variation of air sea fluxes with special reference to upwelling – Transfer of heat and water vapour – Determination of air – sea fluxes – Fronts and water masses interaction -Profile method and non profile methods. Energy exchange and global climate – Radiation and its role on tropical circulation – Indian Summer Monsoons: cause, inter-seasonal and intra-seasonal variability,Monsoon Trough, LLJ, Tibetan Low, Mascarenhas High, TEJ, El-nino, La nina. Tropical cyclones: Cyclone structure, Generation, growth and decay. Temperature, pressure field and wind speed and direction. Cyclones in North Indian Ocean, – Instruments used in marine meteorology – Concepts in climatology, fundamental oceanic processes influencing climate – climate change.	12 hours 12 hours 12 hours 12 hours
Pedagogy:	Lectures/Tutorials/ assignments	
References/ Readings	1. Monitoring & prediction of tropical cyclones in Indian Ocean & climate change, 2014 - U. C. Mohanty, M. Mohapptra, O.P Singh, B. K Bandhopadhyay & L. S. Rathore. 2. Hot Spots in the climate system, 2016 - Nakamura H., Isobe A., Minobe S., Mitsudera, H. Nonaka M., Suga, T. (Eds.), Springer. 3. Air Sea exchange of heat and moisture during storms, 1987 - R.S Bortkovskii, Revised English edition by Edward C. Monahan, Springer. 4. The physics of marine atmosphere, 1965 - Roll, H.U., Academic Press, London. 5. The sea: Ideas and observations (Vol.1), 1962 – Hill, M.N.(Ed.), John Wiley & sons, New York. 6. Oceanography for meteorologists, 1945 – Sverdrup, H.U., George Allen & Unwin, London. 7. Principles of physical oceanography, 1996 – Pierson, W.J. and Newman, G., Prentice Hall Inc., New Jersey, U.S.A. 8. Introduction to theoretical meteorology 1959 – Hess, H.L., Holt, Rinehart & Winston, New York. 9. Tropical meteorology (Vol. 1 & 2), 1993 – Asnani, G.C., Asnani Publ., Pune, India. 10. The physics of monsoons, 1992 – Keshavmurthy and Rao, Allied Publ., New Delhi. 11. Climate change, 1995 – Houghton, J.T., Cambridge Univ. Press, U.K. 12. Climate of South Asia, 1997 – Pant and Kumar, John wiley. 13. The Dvorak Tropical Cyclone Intensity Estimation Technique: A Satellite-Based Method that Has Endured for over 30 Years, 2006 - Velden, Christopher, and Co-authors, *Bull. Amer. Meteor. Soc.*, 87, 1195–1210.	
Learning Outcomes	Explain exchange of momentum, and energy and their role in climate. Explain southwest monsoon and tropical cyclones. Generation of waves, El Nino and La Nina.	